Skills Research Initiative
Initiative de recherche sur les compétences

Post-Secondary Educational Institutions' Adjustment to Labour Market Changes: Major Concerns and Key Research Issues

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ABSTRACT

In this paper we argue for an enhanced market structure for PSE as an important means of adjustment of PSE to labour market changes. However, this market orientation, in our view (and other authors' opinion), can only be implemented after disentangling price mechanisms and income support in PSE and addressing potential pitfalls of this approach. The paper first briefly presents the theoretical characteristics of a market-based PSE system, then examines various dimensions of the system that could crucially impact on its feasibility. Key issues relating to these characteristics are surveyed, and some of the major concerns arising from the current Canadian system outlined. The basic question of measuring the adequacy of adjustment of the PSE system to labour market changes is also raised. The central role of students in the functioning of the PSE system – both as it is now and in a more market-oriented version – is then acknowledged. Consequently, the importance of understanding students' educational choice processes is stressed as a crucial step towards improving the PSE system's responsiveness to labour market, which should in turn lead to greater innovation and higher living standards (among other benefits).

This is an "issues paper" intended to foster discussion at a government-led roundtable and, as such, emphasizes and underscores what we see as key research issues. These questions and the broader lines of the research agenda that emerges from them are summarized at end of the paper.

RÉSUMÉ

Dans notre étude, nous considérons qu'une structure de marché perfectionnée peut aider, de façon importante, le système d'enseignement post-secondaire (ÉPS) à s'adapter à l'évolution du marché du travail. Toutefois, à notre avis (qui est partagé par d'autres auteurs), cette stratégie ne peut être mise en œuvre qu'une fois que l'on aura démêlé les mécanismes d'établissement des prix et le soutien du revenu à l'ÉPS et que l'on aura examiné les problèmes qui peuvent se poser. Tout d'abord, nous brossons un tableau des caractéristiques théoriques d'un système d'ÉPS fondé sur le marché, ensuite, nous examinons diverses dimensions du système qui pourraient avoir une incidence importante sur sa faisabilité. Nous présentons les principales questions liées à ces caractéristiques ainsi que certaines grandes préoccupations soulevées par le système canadien actuel. Nous posons aussi la question fondamentale de l'évaluation du degré d'adaptation du système d'ÉPS au marché du travail. Nous reconnaissons le rôle central des étudiants dans le fonctionnement du système d'ÉPS – dans sa version actuelle et dans une version davantage axée sur le marché. La compréhension des processus de sélection des domaines d'études par les étudiants est donc une étape essentielle à l'amélioration de la capacité du système d'ÉPS à répondre aux besoins du marché du travail, ce qui devrait, par ricochet, mener à l'accroissement de l'innovation et du niveau de vie (entre autres avantages).

Le présent « document de fond » vise à alimenter la discussion à une table ronde organisée par le gouvernement. Il contient donc les questions de recherche que nous estimons primordiales. Ces questions ainsi que les grandes orientations de la recherche qui en découlent sont décrites brièvement à la fin du présent document.

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1. Introduction

In a context of increasingly rapid changes of the labour market and the corresponding workforce requirements, as well as predicted (and possibly observed) labour shortages in a varying number of geographical and economic sectors, it is of interest to address the theme of the post-secondary educational (PSE) institutions' adjustment to these labour market changes. While much work – both empirical and theoretical – has been done on each sub-question related to the matter and presented here, there appears to be, at least to these authors' knowledge, very few contributions bringing all of these questions – and possible answers – together. This paper thus seeks to put down the key issues at stake for consideration and discussion, in the hope that fruitful research questions and orientations on the matter will emerge. However because it focuses on issues related to the linkage of the *labour* market and the PSE system, one thing this paper does *not* do is to address the broad and equally important question of *research* funding at PSE institutions[1].

The paper is organized as follows. We first attempt to summarize the role that colleges and universities play with regard to the labour market. Section 3 describes the market for PSE, a view deemed appropriate by the authors. This includes the treatment of two important issues: that of student borrowing, which when properly designed acts as a supporting device for market-based PSE, and the question of the direct financial participation of industry to PSE funding. The following section contains a brief presentation of the adjustment process(es) to labour market needs (that should be) taking place in the PSE market, while section 5 asks the question of how adequate these responses actually are. Issues such as approaches to measuring the adjustment – and the ensuing data needs – or differences in institutional responses to changes on the labour market are addressed. Finally, because students are the carriers of most signals sent from the labour market to PSE institutions –whether or not the latter operate in a market system – section 6 touches on the determinants of students' educational choices. Among other things, the importance of economic perspectives on the job market is stressed, and a number of characteristics of PSE (mostly related to its product – graduates – and to its interaction with the labour market) are highlighted. Section 7 concludes, and a summary of the proposed research questions – which are scattered throughout the text – is included in section 8.

[1] This question is nonetheless potentially related if it affects the institutions' capacity to react to labour market changes. For instance, Ehrenberg *et al.* (2003) find that the growing proportion of research costs borne by US universities could result in higher tuition for students as well as lower faculty/student ratios. In other words, the resulting displacement of resources may impact the institutions' adjustment abilities. These second-level considerations are voluntarily left out in this paper.

2. Labour Market Role of PSE Institutions

Perhaps the simplest way of supplying training and education that match firms' labour needs could be found in a system where the firms themselves provided all this training to would-be employees. There is indeed strong empirical evidence in Canada of training of current or new workers in firms (see Turcotte, Léonard and Montmarquette, 2002). There are also instances, particularly in the USA, where large firms unable to design the training they needed with universities have hired their own professors to set up training programs that were adjusted to their workers' needs. This is equivalent to firms creating their own educational institutions; they include such companies as IBM, Microsoft, and pharmaceutical companies[2]. In turn, many educational institutions have developed professional programs offered to targeted groups or employees of specific companies. The insurance and financial sectors have benefited from such programs with business schools across the country as these industries needed good managers and were willing to help with funding their training. This mechanism, which constitutes a clear way to signal to PSE institutions the needs of the labour market, is an illustration of the fact that industries and firms are often willing to pay institutions to train their current or future employees – especially if the training is specific to their needs.

Research questions:
How frequent are these types of contracts, where employers directly pay for – or provide – their employees' PSE?
Under what circumstances are they most likely to emerge?
What types of firms, workers and institutions (colleges, universities) are involved?

If these types of training clearly exist, they are not the patterns of training provision generally observed and, thus, discussed in this paper. Education, related to cognitive aptitudes and abilities, and Training, which produces skills[3], are usually (though not always) provided in institutions and settings that are physically and administratively outside the firm, thus creating a labour market on the one side, and an "education market" on the other. On each of these markets, the demand (supposedly) expressed is (assumed to be) met by the supply side. In the case of PSE, the main role of educational institutions with regard to the labour market is therefore to provide PSE so as to respond to the demand. Now since the demanders for PSE are students who will eventually realize the returns on their education by supplying their work on the labour market, and because these students are linked with the labour market needs, it can also be said – somewhat crudely – that the institutions' role is to provide the labour market with an "appropriate" workforce, in both quantitative and qualitative terms.

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[2] Clearly, other reactions are possible for firms unable to find a local labour force suited to their needs, such as outsourcing work in other jurisdictions and relying on immigration.

[3] This distinction is borrowed from Lévy-Garboua *et al.* (2004): Education can be an input to Training but it is not usually demanded *per se* by employers, who will seek potential employees with general or specific skills in particular, which are normally acquired through some form of Training.

3. The Market for PSE

When discussing markets in general, economists stress that competitive markets are the best institutions to ensure the efficiency of the exchanges among agents through the mechanism of prices. Economists are also aware that market failures can arise, notably in the production of public goods. But for economists, a public good is not a good whose main feature is to be supplied by a public institution, but rather a good that can be consumed by all at the same time and the consumption of which no one can be excluded. Examples of "pure" public goods include the national defence, pollution fighting, or the sharing of information and knowledge. As no individual agent has an interest to bear the cost of producing a public good, which once produced will be free to others, the production of such goods needs the governments' intervention.

However, to argue that PSE institutions produce a public good is surely wrong. There are a limited number of people who may receive training at a given time[4]. When those institutions are "public" (or subsidized), PSE is not more of a public good, but essentially a private good that is (at least in part) collectively financed. Implicit in this reasoning is that PSE institutions produce training or a human capital investment whose rate of return depends on working in the labour market. It is reasonable to argue that education can also be a consumer good, but this portion clearly yields a private satisfaction, not a collective one. Now if education is not only an investment but also a consumer good, the case presented in the following pages for a market-pricing system is even stronger.

The argument of a higher social rate of return to PSE due to higher taxes paid by more educated people may be a valid one, if the tax system is indeed progressive[5] – which, however, means that uneducated people with high incomes also pay more taxes. On the other hand, the argument often heard that an educated person is a better citizen caring for his/her health, country and the environment, for example, thus creating positive externalities that can be associated with characteristics of a public good, may only be "wishful thinking". Apart from the fact that uneducated people can also share these values, the causation effect behind the observed correlation between participation in higher education and appropriation of socially desirable values remains unclear[6] – and in any case might only represent a small portion of the total benefits to PSE[7].

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[4] Borjas (2004) offers a clear illustration of this fact by raising the issue of foreign students crowding out native (US, but mostly White) students in graduate programs.

[5] Some economists will argue that, although the income tax schedule is undoubtedly progressive, the Canadian tax system *taken as a whole* is in fact barely proportional.

[6] Heckman and Klenow (1997) as well as Acemoglu and Angrist (2000) question the existence of externalities to PSE. Supporting the externalities position is a literature review by Davies (2003) who argues that, in an endogenous growth model setting, there is indeed a case for subsidizing higher education on the grounds of increased average productivity. On the other hand, evidence reported by Ehrenberg (2003) suggests that while this may be the case, whether states or local jurisdictions can capture the benefits of these externalities at a smaller scale is highly doubtful.

[7] Recent evidence mentioned at the Roundtable by W. Craig Riddell is said to be pointing towards social returns to PSE of the same magnitude as the private returns. The authors were unable to exp lore this.

Taking a market view of PSE, with institutions supplying education to students who demand it, many economists will argue that optimal adjustment would require that students truly bear the full costs of their PSE (including foregone earnings and tuition). The question of PSE market and market pricing is then two-fold:

- In an ideal world, is it feasible to use a competitive price mechanism (market) to fund PSE institutions? If the answer is positive, a follow-up question is: why is it not used?

- Does public funding of PSE institutions constitute a factor detrimental to the adjustment mechanism between the demand and the supply of a qualified labour force? If so, what are the consequences of this inefficiency and how can the system deal with this?

PSE and price mechanisms

The answer to the first part is clearly "yes". There is no evident reason not to have a competitive pricing system in the market for education. Now how would such a price mechanism work? Assume an increase in the demand for a specific profession. Employers become willing to pay higher wages if there is no substitute, which should attract more students in the corresponding field(s). To produce more graduates in that field, more resources must be devoted to that sector to meet the higher current or expected training demand by students. To achieve this, institutions can either divert more resources toward that field if there is excess capacity elsewhere, or increase tuition for that field in order to access new resources.

Research questions:
Are positive externalities to PSE observable?
If so, how large are these externalities in Canada, and of what kind are they?
What are (well-working) examples of jurisdictions using market pricing for PSE?
Do PSE institutions operating in such a setting exhibit a greater level of adjustment to labour market[8]?

In fact, there is already some competition and a "price" mechanism[9] at work in some segments of education. At secondary level, private institutions exist and compete with public institutions to attract students, and they sometimes refuse public subsidies in order to protect their freedom to offer their own schooling program. Some post-secondary institutions (colleges) also are private, and even universities are now contemplating this option. So why is the pricing mechanism not generalized as it should be? The answer lies in the presence of public PSE institutions that largely operate outside the economic market and more in the context of a political market. It is very interesting to realize that historically even elementary education depended almost completely on private funds.

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[8] The issue of measurement is explicitly taken on further down.

[9] Obviously there is no real competition *on prices* in a system where prices at public institutions are fixed – and at a very low level. Rather, private institutions will innovate in offering different services (placement support, internships) or "products" (special courses or field concentrations) to attract "clients" (students), thereby playing on the quality of the product offered.

West (1965) in a paper on "Education and the State" has argued that school attendance and literacy rates were above 90 percent before the State became involved in education in England and Wales. This was the situation with most countries in the early nineteenth century. Faced with the success of formal education, it was recuperated by the public sector and the political process.

A price mechanism acts as a signal on a market. Adjustments will eventually follow, but there could be important lags involved. It takes time to produce a qualified person; thus, the training received is expected to be useful for many years in the labour market in order to obtain a reasonable rate of return on the human capital investment involved. There is a time opportunity cost for those investing in human capital and since the return is spread over time, investing in human capital is a risky business. What if the student fails to succeed in post-secondary schooling? What will happen if after a few years the human capital acquired becomes obsolete, or if the demand associated with one's training vanishes? Training is thus different in that respect to many goods produced in the economy. However, there are a number of risky real investments that take time before yielding returns. Financial markets are used to handle these kinds of risky investments.

With a human capital investment, one additional difficulty is the absence of collateral from the fact that we cannot separate the investment from the individual. Yet for many fields of study, private loans are available. This is the case, for example, for students in medical and management schools, where students have no difficulty obtaining favourable loans from banks and other lending institutions. The institutions know that they will get their money back and they are interested in creating a business link with future wealthy borrowers.

However, the private financial sector will be reluctant to finance students in areas where the labour market demand appears to be weak. Therefore, in fields where the expected labour market situation is not as clear, students from less fortunate backgrounds must rely on government loans to access education. If an investment is riskier than others, a risk premium can be added to the loans and private institutions will respond. However, if the risk premium is standardized or not taken into account in order to give all students from different socio-economic backgrounds the same chances to access education, pricing mechanism is avoided with a potential misallocation of resources – some students will take more risk than they should (and conversely). The failure to separate the price system from an income support program is socially inefficient and, hence, costly. This is why the authors see the introduction of "true prices" in PSE as a pre-requisite to any further modification to other possible adjustment mechanisms that may exist.

The mainstream argument to justify the public sector presence in education is the general access to education offered by the governmental policy. But as mentioned before and as in most cases of government interventions, there is confusion between efficient resource allocation and income redistribution policies. The confusion leads to controlling the price system to meet the objective of a redistribution policy. This does not need to be so, and refusing to have a market price for education independent from financial support

programs to permit access to education to less fortuned people is essentially a political decision.

Efficiency considerations and public funding of PSE

This brings us to the second part. It should be clear that if students are "unduly" attracted by low educational prices and financial support while in school (i.e. if these are the only reasons motivating their presence), they are in the end the ones bearing the costs of this inefficiency of inappropriate educational choices by having supported important foregone earnings. In many cases students will also face relatively important debts, to find themselves in a situation where they are unable to sell their acquired skills.

Operating outside the market price system in a public education framework is clearly detrimental to signalling the demand for a qualified labour force and to market adjustments, as will be argued below. Some will argue that the increase in the accessibility to post-secondary education associated with tuition subsidizing policy helps creating a larger pool of qualified people and is therefore useful to the labour market. However this argument is only valid if workers can market their acquired skills, which is clearly not the case if there is no demand for these skills[10]. The conclusion is therefore that it is far from obvious how PSE developed outside the labour market can add to the pool of qualified workers.

PSE financing: Student borrowing and ICLPs

The issue of student borrowing – usually contracted in Canada through publicly administered loans programs –must be stressed as a crucial issue because of the role it can play in easing the implementation of more direct connections between PSE and labour markets. Clearly, as noted above, investments in human capital are different from other types of investments in that they cannot be backed by material collateral. Unlike investments in machinery or real estate, human capital has nothing tangible to offer to the lending institution in case of default. To facilitate access to higher education to everyone, regardless of his or her financial situation, and with a capital market viewed as an imperfect institution when it comes to offering loans to students, governments are invited to step in as lenders. This is why the Canada (or Quebec) Student Loans Program (CSLP) provides the necessary loans to students with "demonstrated" need. On some grounds this is a valid policy, but it also weakens the link between the demand and supply of educated people as well as the interaction between the two.

It might be possible to achieve both goals – that is, support needy students while at the same time keeping some link to the labour market – with an adjusted income contingent loan program (ICLP). An ICLP works in the following way. All PSE students are allowed to borrow through a public loans program, borrowings that they only repay once they graduate. However the repayments are made in proportion to the graduate's income, and usually only when the latter exceeds a certain threshold. Such a program reduces *ex post* general risk and promotes human capital investments.

[10] Whether this is possible will also be partly conditioned by the non-segmentation of the labour market with respect to fields of study, and it is not independent from the general-versus-specific composition of training. Both issues are tackled below.

An additional feature that could link this program to the supply side would be the conditioning of public financial support given to post-secondary institutions upon the success of the ICLP program in the remittance of the student loans. This would give incentives to PSE institutions to create and favour programs that have better chances of employment for graduating students. This option, which would also face difficulties[11], has been dismissed by authors such as Barr (2003), in all likelihood on the grounds of the timing of funding availability.

The British reforms recently put forward by the Blair government[12] work in the general direction of an ICLP. Students will have the option of paying no tuition until they graduate and get a job, and then pay for their education (including any loans they took up) on an "ICLP" basis – i.e. according to the income they earn above a defined and inflation-adjusted threshold. However there will not be any explicit link between the institutions' public funding and the loans remittance performance of their students; but the system will allow for a tuition fee schedule differentiated by program of study, a notion implicitly introduced above[13]. Australia has also chosen to move down that road some time ago.

Research questions:
How do the British and Australian ICLPs perform with respect to their goals?
Which elements of these programs could be implemented in the Canadian context?

PSE financing: Corporate participation

It is argued here that public funding for PSE should be provided cautiously, in a way such as not to unduly distort the signals and mechanisms usually at work in markets. This is not to say that the corporate private sector – the industry – has no role to play in this respect, and that the lion's share of PSE funding should be achieved through student borrowing. On the contrary, economists will often argue that highly specific training, training that will yield benefits to a single industry or even only one firm, should be almost entirely funded by the corporate beneficiaries. A corollary to this could be that governments should pay for specific training of workers for whom it stands as the main

[11] Not the least being the determination of the "unit of performance": Departments? Universities? The PSE sector as a whole?

[12] The government White Paper on this issue was published in January 2003, and the ensuing Bill was brought to Parliament and adopted early in 2004. The new system can still be critically appraised, however. For instance, the decision to heavily subsidize the new ICLP by charging no real interest rate to students – *and graduates* – is highly political, even though it could turn out to be an essential feature to ensure that the program is viable (e.g. that it does not impose high double-digit rates of repayment). Indeed, the major goal of the British reform is to actually *increase* the funds available to PSE institutions; but Barr (2003) argues that this is possible (and viable) even without interest charges subsidies.

[13] Using a market pricing system for PSE implies that students pay the "true price» of their training, which will differ by field or program. This is different from pricing considerations related to 1) students' expected future earnings ("students in med school should pay more than students in history"), and 2) institutions' internal cross-subsidization practices or policies – implicit or explicit. In practice, these three dimensions will certainly interact in the political arena to determine the actual outcome in terms of fees charged.

(or sole) employer. But the point made here instead relates to the idea that the industry could play a more significant role in PSE funding.

Of course, it already does so in Canada by means of various "sponsoring" activities, such as paying for having a corporate brand or name associated with some physical premises. However, what is meant here is rather for employers to pay more or less directly for part of their would-be employees' *general* training – in a context other than that of a 'tailored course' prepared specifically for a firm. Although this may seem to be a potentially difficult agenda, recent research suggests that under certain conditions it might also be in the employer's interest to fund general training[14].

The phenomenon is not unheard of in Canada, two common examples being Canadian universities in the 1970s (who paid full tuition for their best students to obtain PhDs at prestigious foreign universities) and the Armed Forces up to this day (who will provide a university education in certain fields at no financial cost for their future officers). While it must be acknowledged that these contracts usually include(d) a clause requiring the graduates to work for the employer/funder for a minimum period of time after graduation (e.g. five years), it would be difficult to argue that the degrees funded were firm-specific (although they could have been somewhat "industry-specific" in the PhDs case).

Research questions:
How frequent are these employer-student arrangements, for training that is relatively general in nature?
Under what circumstances are they most likely to emerge?
What type of individuals and employers are involved?

[14] See for instance Acemoglu and Pischke (2000). These authors argue that even in the context of a competitive labour market, the financing of general training by firms is possible if the latter have a form of monopsony power following the training of their workers, due to the firms' exclusive knowledge of their workers' quality (a knowledge acquired through the realization of the training).

4. Adjusting PSE Supply to the Labour Market

In the "base-case" scenario mentioned above, where firms train their employees directly and by themselves, there is no real adjustment process operating since (future) employees are hired (for training) as the needs arise and as the forecasts change in a single, unified market. In the context of a market-based PSE system, just described, the main mechanism at work is pricing, which acts on the signal carriers – (potential) students. Thus, it appears that it is primarily through the choices of students on the PSE market, explored in section 6 below, that PSE institutions receive signals of change or mismatch from the labour market.

Where there is a demand and a supply, market forces cannot simply be ignored. For instance, when the demand for computer analysts and programmers surged in the late 1990s, the computer sector saw the emergence of a great number of partnerships between firms and private and public schools in the design of the training requirements and in the funding of specific programs. These kinds of partnerships exist in many trades, as was pointed out earlier. Their characteristics are generally that 1) the demand is clearly identified; 2) the training is specific (at the industry level) and relatively short; and 3) there are low transaction costs for firms and the industry to meeting regional PSE institutions to develop a formal agreement. The latter is certainly true of Quebec's CEGEPs, many of which are designed as regional institutions with a "transmission belt function" between specific technical programs and the labour market (in forestry, the agri-food industry, etc.).

This remark raises the question of the balance between the level of specific and general training to be offered by post-secondary education. There are no simple answers here, but the following thoughts might fuel the debate. If the level of uncertainty (an issue explored again below) about labour market demand in the future is very high, then a general training should be encouraged; and in this case PSE adjusting to the labour market will become less of an issue, the graduates with a general training being more flexible on the labour market. Otherwise, the PSE system might need to make more substantial adjustments to the training provided depending upon its level of specificity.

A related matter is whether the level of uncertainty increases along with the level of qualification. Are we more certain about the short-term market needs for low-qualifications professions such as mechanic, painter, machinist and the likes than we are with respect to the specific types of physicists, chemists or engineers that will be in demand over the next ten years? One will be tempted to answer positively to this question. If this is the case, then PSE institutions concerned with lower skill requirements should be reacting to the demand side of the labour market, since this type of qualifications takes a relatively short time to acquire if and when older ones become obsolete. On the other hand, with the highly qualified workers needing general training in various disciplines, the emphasis should be put on the supply side. There is a case to have institutions preparing students for an uncertain labour market that will attract the best among them, who will benefit from the best training. One way to obtain this is with a

level of competition among institutions to attract the best students and the best teachers. Now is this level of competition present among the different types of post-secondary institutions? And is it possible to obtain an appropriate level of competition in the Canadian system of exclusively public universities?

We have been arguing – and will be arguing further – that a market approach to post-secondary education is hard and eventually costly to avoid. But what are the specific labour market signals that should be of concern to PSE institutions? In the short-run, excess demands for qualified workers express themselves with an upward pressure on the wages paid to these workers. Another manifestation of excess demand is announcements in newspapers or other media for the hiring of specific types of workers. In many cases, we also observe employers from specific industries and their associations publicly stressing anticipated shortages of workers due to a strong demand for their products, or for demographic or other considerations. Assuming potential students take those signals seriously, they will look for PSE institutions to provide them with the training required to meet those labour market demands. An inflow of applications should hit the post-secondary institutions in the disciplines concerned, which will trigger – or not – a reaction by those institutions. In this scenario, the labour market signals reaching the post-secondary institutions come from their potential customers: the students. But as highlighted below, obstacles for short-term reactions by PSE institutions could come from constrained human and physical resources, or from other administrative constraints or processes – which in turn *may or may not* be intrinsic to the production of PSE.

Now would it be conceivable that PSE institutions be directly affected by labour market signals, without passing through students? The obvious answer is: "why not"? However, there could be obstacles here as well, one of them being related to the sources of financing of post-secondary institutions – if they are mainly public, the *political* market will be more important to them than the *labour* market[15]. But in fact, PSE providers selling training directly to employers are a good example of labour market signals that are not passed along strictly through students. However, employer-sponsored education is most likely to be specific rather than general since employers more frequently ask and pay for specific qualifications (we come back to this later). It will alleviate the employers' risks of facing shortages of qualified workers. To some extent, it also offers insurance to students of insertion in the labour market; however, this insurance can be limited in time. The attractiveness for students of such programs is in relation with their perceived long-term usefulness, the time-cost associated with acquiring the competence required and the student's usual opportunity cost (next best alternative). An interesting case to be studied is the wave of computer-training sponsored programs associated with the Y2K.

Despite and beyond the basic reactions just described, in many instances and in the absence of proper (price) signals PSE institutions often react and adapt to changes in other ways available to them in the prevailing setting. One common reaction of

[15] Another obstacle is the attitude of such institutions towards the concept of economic market. Slogans like "education is not a good" or "education is a right that should not be at the mercy of the markets" are obstacles to labour market signalling – a cultural problem that cannot be dismissed easily.

institutions is to use rationing as an adjustment mechanism, which is usually expressed through admissions quotas, or through less formal and more implicit screening processes taking place after admission. The result of this rationing is an "administrative" allocation of resources among each institution, based on the perceptions of, and information possessed by the institution's management[16]. Whether this allocation results in socially efficient outcomes remains an open question.

Research questions:
Generally speaking, what are the institutional barriers to adjustment by PSE institutions (such as delays in faculty hiring and equipment replacement)?
How do these barriers vary depending on the specificity of the training provided?
How do these barriers vary depending on the type of PSE institution?
Is there evidence that the political market, rather than the labour market, is the reference for PSE institutions?
How is rationing used by PSE institutions to manage their supply?

Another strategy, which is sometimes more of a – perhaps unintended – consequence of rationing, is the cross-subsidization between programs of study. This may especially occur in a setting where, as in the province of Quebec, all students pay the same tuition in every course of study, independently from the cost of providing each particular course of study. Cross-subsidizing programs will often give PSE institutions some form of flexibility in deciding which programs to offer and the number of slots available in each one. For instance, opening a large number of slots in low-cost programs (e.g. in the social sciences) will yield a substantial "operating surplus" in these programs which can then be transferred to cover the higher costs of other programs (e.g. in natural sciences and engineering, or NSE)[17].

Thus by using a rationing canvas (i.e. admissions quotas in NSE) in conjunction with implicit or explicit cross-subsidies (from social sciences towards NSE), PSE institutions would somehow be able to achieve two sets of objectives – their financial objectives and those related to the various cohort sizes. This process is postulated and described by Romer (2000) for the USA. It might be relevant to note that while rationing appears to be fairly easy to implement in the short-run, the full effects of cross-subsidies may take more time to operate (due for example to faculty-hiring or equipment-replacement processes).

The combination of the two mechanisms may lead to better student quality in "subsidized" (and hence rationed) programs and poorer quality in the "subsidizing" ones, but the determination of whether the actual number of graduates in each is socially optimal has yet to be established. Since it can be assumed that institutions will react to

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[16] However, Ehrenberg (2003a) underscores that "one theme that emerges [...] is the conflict between the interests of faculty and administrators at public universities and the interests of the state that is funding the institution" [p.19], making rather unclear what these perceptions and this information could be.

[17] As (accurately) pointed out by David Laidler at the Roundtable, there is also substantial cross-subsidization occurring between universities' teaching and research activities (usually in favour of research). In Laidler's (and other Roundtable participants') view, this cross-subsidization is well-known to management and mostly deliberate.

students' choices as the PSE entrants "vote with their feet" (see Lemelin and Vaillancourt (1999) on management and computer sciences) in the long-run, it seems that there should be no fear of maladjustment. But for this proposition to hold when talking of adjustment *to labour market changes* students must possess very good information about the said labour market – at least good enough to ensure that aggregating individual choices will yield a social outcome that is "acceptably" close to the optimum. Now it seems that poor information is often available to students, as argued again by Romer (2000) for the case of NSE degrees in the USA. The questions of information and of whether this crucial caveat can be fixed (and if so, by whom) are explored in section 6.

A different situation arises with the so-called "public markets" (e.g. the "market" for nurses), where the government is not only a major funder of training but also the main – or sole – labour demander. This type of "market" is usually characterized by heavy constraints on both the labour supply (admissions quotas for subsidized training) and demand (which is then mainly conditioned by the po!itical process determining the allocation of public funds). These "markets" present additional difficulties in terms of coordinating their needs with the educational offer, because even more of the otherwise usable market signals are removed than in other cases. A common response to this seems to have been the implementation of further rules and constraints to artificially "plan" both the demand and the supply of these categories of workers.

Research questions:
Is there cross-subsidization in Canadian PSE institutions?
If so, how substantial is this phenomenon and how does it impact the institutions' adjustment in different fields – if at all?
In how many and in which fields do governments directly manage PSE supply?
What is the institutions' leeway for adjustment in such contexts?

5. Adequacy of PSE Institutions' Adjustment to Labour Market Needs

The adjustment processes just described and suggested may or may not yield "adequate" results, in the sense that they may or may not generate labour or skill shortages that are longer or more complex than would be possible, or lead the PSE system to produce too few graduates (or with the wrong qualifications). At that point, we are thus worried by the size of the obstacles identified to alleviating or removing the pressure of students' demands, and therefore reducing the size and intensity of actual and anticipated shortages.

This problem is multi-dimensional. The main dimensions relate to a number of variables that can be measured, but this exercise often requires data above and beyond what is available. The objective here is to understand how well the various PSE institutions have responded to changes observed on the labour – this being measured for each institution individually as well as grouped (e.g. by type or level) or for the system as a whole. The variables/dimensions could include:

- ***Level of completers, at each level and in different fields of study;***
- ***Success of graduates' career path and/or satisfaction of the graduates in this matter;***
- ***Returns to PSE in different fields, changes in the latter, trends analyses;***
- ***Matching of employment and graduation trends;***
- ***Correlation between characteristics of PSE systems (such as structure, attendance, rules, financing sources) and their response ability;***
- ***Pattern of response to short-term changes versus response to long-term changes: trends comparisons;***
- ***Possible existence of shortages in different fields and at different times.***

These could be explored as ***research questions*** on the theme of how well-geared the PSE institutions are to the labour market, both at the Canadian (provinces) and international levels. It also seems relevant, as mentioned above, to analyze these questions by (type of) institution, which may help understanding what characteristics are more (or less) desirable when it comes to institutions making quick and appropriate adjustments to perceived changes. The example of CEGEPs, mentioned above, could be insightful – although even elsewhere in Canada, community colleges or research universities may not respond in the same way as teaching universities, for instance, to changes in the labour market.

A pervasive difficulty in measuring all these variables is the availability of data, which could advocate for more limited "case studies" for certain fields or segments, using whatever data is available. The data question is taken up below; but we first present an example of the "basic measurement" that the variables suggested allow, one that adds to others already mentioned (such as Lemelin and Vaillancourt, 1999).

The phenomenon of "over-education" and "under-education"

It is sometimes possible to evaluate the qualitative and quantitative aspects of the matching between labour market and the educational system. For instance, over-education can be seen as the difference between the educational level reached by an individual and the educational level required for his/her job. This notion is a relative one: someone with a college degree will be over-educated if working as a barman, but under-educated in an engineering job. As Freeman (1976) put it, the phenomenon of over-education is observed when the qualified workers' supply increases while the demand for these workers falls. This forces workers to accept jobs for which the required education level is lower than theirs.

It is too restrictive, however, to refer only to the individual's educational level. It is necessary to take into account others factors, such as the unemployment rate. If the latter is high, the important issue for people may be to find a job, even if the required level of education does not exactly match their own level of education. The level required will generally be lower. On the other hand, work experience is equivalent to a diploma in the theory of human capital. This is a plausible explanation for *under*-education.

According to Turow (1975), hiring an overqualified person can be seen by an employer as potential saving on training. Furthermore, an over-educated person may understand more rapidly the tasks to be carried out. For Sicherman and Galor (1990), working as over-educated can be seen for the worker as the opportunity to acquire non-schooling qualifications that can be used later to obtain a better job. The phenomenon of under-education is most difficult to explain. It can take place when the employer faces a labour shortage, which would mean that he must hire workers who are less qualified than the people he is looking for.

Montmarquette and Thomas (2003) investigated the causes of the noticeable difference between the education level achieved by workers and the level of education required for their job in Quebec and Ontario for 1991 and 1996. They observe that the over-qualified workers are usually younger workers, while older workers compensate for their lack of formal education by having more experience. The outcome of over-qualification or under-qualification is real. Over-qualified individuals are paid more than people who have the proper education for their job. On the other hand, under-qualified individuals are usually paid less. The authors also find that, in this regard, the labour market in Ontario shows a better matching than the one found in Quebec. But to reach further conclusions on such matters, the issue of data availability is inevitably raised.

Data and measurement: What is a (good) "level of (un)adjustment"?

One key research question underlying this paper is, implicitly, how to measure the level of adjustment – or lack thereof – between the educational sector and the labour market. This is difficult and as for many research questions with a strong empirical content, data availability is fundamental to developing a credible research agenda. We offer a few thoughts and studies that illustrate this concern, keeping in mind that *any initiative seeking to help improving the data available to answer these questions and the ones posed above will have an important part of the work done.*

Matching education and labour sectors

In comparing the proportion of graduates in Québec and Ontario by fields of study within the context of the labour market, Montmarquette *et al.* (2000a) wanted to see how closely related were the university educational sector and the labour market in these provinces. One noticeable difference to emerge was the number of Québec graduates with a "certification degree", far greater than with the usual bachelor's degree. A certification degree is by definition easier to obtain than a bachelor's, since it corresponds to a mixture of introduction courses from various (sub-)fields. It is not clear how well those with such a degree have done on the labour market but, despite any possible beneficial (e.g. complementarity) effect for the students, it is known that the creation of the certification degree was largely seen as a source of additional funding for Québec universities (whose main source of funding is not tuition but government subsidies based on the number of registered students). As a proportion of all graduates with a bachelor's degree, Québec has produced over the 1994-96 period a relatively greater number of graduates in the health and education sectors than Ontario. The latter province was particularly strong in social sciences and biology.

Another difference is the large proportion of bachelors in management in Québec compared to Ontario's. In Ontario, students first obtain a degree in a specific field before getting into management. How much of this is related to the demand side of the labour market and to the supply side of the educational sector is not crystal clear. However given the different sources of funding for universities in the two provinces (mainly the very different proportions for which fees and subsidies account), one can speculate that Ontario is more "labour demand oriented" than Québec, which would be more "education supply oriented". However, more complete data would definitely be needed to substantiate this remark.

Also, when the authors compare the rate of return by fields of study in the two provinces and the proportion of bachelors in those fields, two statistics stand out. Management, where the rate of return has been estimated to over 10%, accounts for 17.7% of all bachelors in Québec as compared to only 8.9% in Ontario. However education, with a rate of return of less than 10%, was found to account for 17.2% of all graduates in Québec against 10.6% only in Ontario. And when comparing the relative size of the sectors of activity in the economy (services, manufacturing, government, research, etc.) with the proportion of graduates in corresponding fields, the authors find a fair match-up between the working and educational sectors in both provinces. This in itself is an elementary form of conclusive diagnosis about the "level of adjustment" referred to above. However this question – as most others – proves to be a complex one and, as the authors note, *longitudinal* and *micro*-data would clearly be required to pursue this analysis any further.

Educational and labour markets segmentation

One important type of measurement concerning the adjustment between the educational sector and the labour market, also attempted by Lemelin and Vaillancourt (1999) for computer science and management – and more generally by others, is to establish for each field of study how many (and which) sectors of the economy hire its graduates, as

well as how many types of jobs can be filled with the same diploma. The idea behind this operation is the following: training obtained at an educational institution can be rather specific but could interest many sectors of activity and could lead to many different jobs. Engineers, for example, can be found in most sectors of the economy and the individual trained as an engineer may work as an engineer, but also as a manager, a salesperson, etc. In other words, a field of study can be highly "segmented" in the training it offers, but not necessarily be so with respect to the occupations it leads to.

Similarly and conversely, we may find that some occupations or sectors use only graduates with a particular training. A medical doctor, for instance, can hardly be someone with only an engineering background or diploma. This question is important because a non-segmented occupation will be less likely to face a shortage of qualified workers since the work involved may be done by graduates from different fields. It also reduces the risk of students not finding a job after graduation or at any point during his or her career. Somehow, this characteristic of occupations and courses of study can be seen as a form of livelihood insurance in itself.

Along those lines and in the face of the increasing ratio of women to men in universities, the question of segregation by sex between the educational sector and the labour market is also an issue. One can wonder whether some economic sectors will face a workforce shortage in the coming years due to this question. The article by Borghans and de Groot (1999) explains the relationship between pre-sorting and occupational segregation. Occupational segregation is the propensity to construct stereotypes for certain jobs according to the worker's sex, leading to some occupations becoming known as "women's jobs". In the same way, educational segregation can be seen as the propensity to construct stereotypes according to sex in education, so that some training courses become known as "women's education". It is important to note that educational and occupational segregations can change independently and even in opposite directions over time. This implies that, for a given degree of educational segregation (which can be considered as fixed in the short-term), there still exist possibilities to decrease overall occupational segregation. Applying this approach to data from Québec and Ontario, Thomas and Montmarquette (2003) found that occupational segregation is more important in Québec than in Ontario. An explanation for this result has yet to be developed, but it could very well have implications for the measured level of "matching" between the educational and labour markets in the two provinces under study. It is also possibly related to segregated information problems, similar to those presented above.

Research questions:

How do the suggested variables/dimensions perform at measuring the adequacy of adjustment?

What other types of data are needed to better quantify (and compare) adjustment levels?

6. Student Choices Issues

Elements of shortages and surpluses in occupations are important and complex issues related to educational choice. The arguments put forward in this paper to use market price mechanisms to better gear the educational market to the needs of the labour market rest on the principle that it is the idiosyncratic rate of return on investment that motivates people in their choice of investing in human capital in a specific field of study. But is this actually the case?

Determinants of student educational and career choices

There are many elements entering the choice of concentration (major) made by PSE students. Preferences, information and the family's socio-economic background can all play an important role. Furthermore, choosing a concentration is a decision made under uncertainty. One major element of that uncertainty relates to the expected earnings associated with the concentration chosen. In a recent paper, Montmarquette, Canning and Mahseredjian (2002b) analyzed the extent to which the choice of concentration depends on the expected earnings associated with that concentration, relative to other areas of concentration that could have been chosen. They show using US data from the National Longitudinal Survey of Youth that the choice of college concentration depends decisively on the earnings that can be expected after graduating from a particular concentration. Boudarbat (2003), using data from the National Graduates Survey, reaches the same conclusion based on a model where field choice is a function of expected earnings, unemployment duration and the individual's personal discount rate. Both studies also report that women are less influenced than men by expected earnings. For women, important considerations include preferences for careers compatible with raising a family and for fields of study where their investments are at less risk of becoming obsolete if they need to temporarily withdraw from the labour market. Ehrenberg (2003) reports similar findings by other researchers: while the general choice of major is indeed influenced by other factors, the main determinant relates to the economic opportunities after graduation expected by students[18].

Another important point concerns adult education and, more generally, the educational choices made by older people (potential "returning students"). The federal government has expressed a huge interest in stimulating adult education. A recent large-scale experimental study conducted by Johnson, Montmarquette and Eckel – whose detailed results are unfortunately yet to be released – suggests that the task of stimulating post-secondary adult education is a major challenge with limited success to be expected. Compared to youth (or students taking initial training), adults respond to different incentives and are even more subject to their own perceptions of their situation. This could make them different "signal carriers" from younger students, and they may therefore play a very different role in the process of transmitting labour market needs to the PSE market.

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[18] A related study using Canadian data is Lavoie and Finnie (1997).

In the end, because the students themselves are arguably the prime carriers of signals to PSE institutions, it is essential that policy-makers be able to make decisions that are informed with regards to the effect these decisions will have on the students' behaviour. The term "policy-maker" should be understood here as encompassing the PSE institutions' administrators, who are the ones eventually deciding whether to push forward changes in their institutions – such as the creation or merging of programs or courses of study, as well as the development of institutional rules and structures that ultimately affect students despite their "administrative" nature. The area of research devoted to understanding the determinants of students' choice regarding their educational path should therefore be fully developed in order to replicate and expand the results just described and inform all such decisions.

Uncertainty associated with labour demand: the risks of education and training

Labour demand is usually modeled differently depending on the time horizon relevant for the analysis being carried out. Although the characteristics of the short-term labour demand are often relatively well-known, there is tremendous uncertainty about the medium- and long-term shape and composition of the labour demand function[19]. As outlined above, one of industry's main roles in the PSE adjustment process would then be to make the best forecasts possible regarding its workforce needs in the medium-term at least. This is essential because schooling and training is a lengthy process whereby the new labour market requirements can hardly be met within less than a few years, which is the length of most PSE programs. PSE institutions thus need to know at least 3-4 years in advance what the industry expects its labour demand to be.

In fact, this timeframe may even be over-optimistic in many cases, as highlighted by Lemelin and Vaillancourt (1999). This could be due to important administrative or structural delays in creating new programs and courses or in adapting existing ones. In such a context, the industry's "accurate" labour demand predictions would need to be made over a much longer time horizon, possibly 5 to 10 years.

Because this requirement seems at best unrealistic given the set of tools available and the problems associated with this process at the firm level (i.e. numerous firms may in fact be unaware of what their – "latent" – labour demand actually *is*, let alone what it *will be*), it might be that governments could have a role to play in the matter. For instance public authorities could find themselves to be the best suited to spread the risk associated with labour demand uncertainty among all participants on both sides of the labour market – workers and employers. But is this so?

The answer may happen not to be "yes" if there are ways for labour demanders and suppliers to privately insure against these risks. If it is rather unclear whether this is something possible in practice, there are few reasons to think that it would not be in theory. In fact, the strongest argument against this possibility is perhaps the absence of incentives for a market for such insurance to emerge – in which case the governments'

[19] Correctly predicting the long-term labour demand is a difficult task, but it is not totally impossible for some specific sectors. With an aging population, for example, we know that health workers will be in large demand. With a low fertility level, the demand for teachers should decrease.

role could be one of "market creator" or facilitator. For instance, Shiller (2003) considers the interesting concept of livelihood insurance[20]. Such insurance could exist for every occupation or labour market segment, based on reliable data on career income available over long periods of time, and employers could provide livelihood insurance as an employee benefit (as Alcan now does in various regions)[21]. However the determining market failure here could be the availability of clear and reliable information about the participants to the labour market. We move to the crucial issue of information in the next sub-section.

The idea put forward by Shiller could also address more important problems that arise when innovations create a new, unanticipated demand for skilled workers. To cope with this, it has been suggested to subsidize the supply side of diversified PhD programs in universities, as in Montmarquette and Meunier (2000). In contrast and as mentioned above, the demand for low-skill workers can be considered known given the shorter delays implied by the updating and renewal of the workers' skills, and as such should not be subsidized. Thus, society should let the firms address labour supply issues in the latter case – for example with apprenticeship programs[22].

One possible role for governments with regard to labour market uncertainty may be to make available to students some form of financial support featuring embedded insurance, such as an income-contingent loan program (ICLP), discussed earlier. But whatever the means available to reduce individual risk associated with training and labour market outcomes, one natural way to circumvent this uncertainty – especially when the labour demand is simply too uncertain to be predicted – is to develop a more general academic curriculum rather than one that is specific to one industry. This "institutional reflex", likely to be triggered by the students themselves through their educational choices, may involve the best graduates being hired by firms to work with more senior staff to acquire specific skills. This, in a sense, is akin to the apprenticeship programs just discussed.

An adjustment mechanism suggested by Lévy-Garboua *et al.* (2004) and that may operate on the education market and implicitly deal with risk and uncertainty is the one acting through the mixes of Education and Training – as defined above – which can bring individuals to a given skill level. These authors suggest that a certain skill level may be achieved by combining varying proportions of non-tradable Education and tradable Training. The proportions could vary with the level of uncertainty prevailing in the labour market, at different times and in different segments of the market. The authors believe that their view "provides a strong and, to some extent, new rationale for the

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[20] Shiller's central assertion is that "people should avoid essential risk – risk to society at large – but not insurable risks, which can be spread across many people" [p.38]. He therefore suggests an innovative – albeit possibly non-trivial – way for allowing individuals to insure against "career risks". This scheme, as insurance, would fall within the domain of the private sector (not government, which can regulate it).

[21] Although an ICLP – discussed below – and the investment in general skills may both appear as an alternative way to filling the role of this insurance, the latter differs in that it is an *ex post* measure, like an ICLP, while at the same time a fairly path-dependent (or field/degree-specific) one, unlike the other two.

[22] Although the opposite policy seems to be in place in Canada.

vocationalisation and lengthening of studies" observed in most industrialized countries. In short, an educational system needs diversity and flexibility to face heterogeneous individuals with different levels of ability and preferences and complex labour markets. It also needs bridges between the different components of the system to allow changes in career paths, if and when necessary. This point is raised by the authors.

Research questions:
How do the different determinants of adult education affect these students' "signalling" function?
Is this role similar to the one played by students in their initial training?
How important is the uncertainty faced by students?
How does this affect their choices?
Would it be possible to foster the development of some sort of "livelihood insurance"?
How is it possible to adapt the contents of training to ensure a minimum level of general training as a form of insurance?

The importance of information

It was repeatedly mentioned above that information problems could be among the most pressing when dealing with PSE institutions' adjustment to the labour market. At least two types of information may be required for the desirable processes to work smoothly: the information provided to (potential) students, and more direct information flows between industry and PSE institutions.

The provision of the former type is problematic in various ways. First, private providers of such information will almost certainly respond to different private incentives in elaborating it, thus biasing in some way or another what is made available to students. This is clearly true in the case of PSE institutions themselves, and perhaps even more so (at least in the short-run) if the institutions operate in a market setting. Secondly, this information is often described as a "public good", in the pure sense. The obvious implication of this is that no individual actor on the labour or education markets may find it in its own interest to provide (*neutral and accurate*) information to students.

The latter type of information brings up different concerns, the main one being perhaps that in the absence of any formal integration of industry and PSE institutions, neither faces very strong incentives to collaborate. Of course, as exemplified earlier, this assertion will not always hold. But another important issue is that, as argued before, the industry should be responsible for producing accurate forecasts of its labour demand, a process that is in itself highly uncertain and risky.

From what precedes it could be argued that it should be the governments' role to produce and provide the information to all concerned. However, closer analysis reveals that the governments' role could at best be one of providing the information *distribution* service to all actors, leaving the detailed information's *production* to others (while perhaps regulating that production). One must realize that a role played by a market is to aggregate the ideas of hundreds of thousands of people about the future needs of the labour market. Instead, governments' role regarding information could be at a more

"basic" level, such as providing (1) neutral, general and factual information about past and current values of PSE, maybe in terms of return on investment; and (2) personal career information and career guidance (CI&CG) at a socially optimal level, in order to improve the more delicate match between each individual's personal abilities and desires and the place he or she will seek to occupy on the labour market.

The crucial need for (1) is illustrated for NSE programs and degrees in the USA by Romer (2000), but also in Canada by a number of studies showing students and their families systematically *over*-estimating the real cost of PSE (both in terms of actual outlays and of foregone earnings) while at the same time heavily *under*-estimating the return on investment provided by PSE in general (in terms of higher future earnings)[23]. The need for government-provided (2), on the other hand, is argued by Grubb (2002)[24] for all levels of the educational systems of OECD countries. His core arguments are:

- A market failure that is very likely to produce CI&CG well below social needs both in terms of quantity and quality, especially in the case of CI for those who need it most; and

- A strong *implicit component* in CI&CG demand, requiring for its expression coordinated interventions across all groups of potential demanders as well as others aimed at targeted groups (youth, unemployed, etc.). This may be stronger for CG.

Grubb also argues for the use of an array of possibly appropriate interventions, possibly including actions such as internships and informational activities involving the unions and the industry, rather than the educational institutions. We believe that the implicit component can also affect the need for other and all types of labour market information.

Research questions:
How good is the information provided by PSE institutions to students?
What are the unfilled information needs of students (on labour market, programs...)?
Who should provide this information, and how?
Does the above differ according to socio-economic status – or other variables?

[23] See for instance the work of the Canada Millennium Scholarship Foundation.

[24] Despite (and against?) policy orientations taken recently in some OECD countries, Grubb advocates at least government-*regulated* information (which, to him, can also mean government-*provided* if necessary).

7. Conclusion

This paper has raised a number of questions and issues related to the linkage between the labour and PSE markets. Although most of them have been at least partly addressed in various settings in the past, it still appears that much more research needs to be carried out when it comes to improving PSE's institutional adjustment to labour market changes – especially in a Canadian context. From a labour market point of view, the most important issue at stake in the connections between it and the educational world is perhaps that of skill or labour shortages. While some attempts have been made (see above[25]) at measuring shortages and identifying clear signs of such, the very phenomenon of shortages is still poorly understood – let alone measured – and the role of the education and training supply in this regard clearly has to be probed further. However because improving our understanding of the actual and possible interactions between the labour and PSE markets is likely to improve the match between workers' skills and the labour market needs and, more generally, ameliorate the allocation of human resources in the Canadian society, this may yield an increase in the overall level of efficiency – a dynamic increase given that the process of producing a graduate takes time and involves risk. And as we have seen, the success of this latter process will depend upon many factors such as the existence of clear and appropriate signal mechanisms operating between the PSE and labour markets, as well as the quantity and quality of information produced and available.

One major illustrative area of concern from a scientific (as opposed to industry) standpoint is the Natural Sciences. One can for example wonder whether most jobs in the science sectors of the economy can only be filled by scientists; if this is so, the question of serious shortages of (mainly skilled) labour can be a real issue. If, in turn, it seems plausible that it will have an impact on our living standards (i.e. our collective welfare) through a slowing down of innovation, then this and similar issues must unquestionably be addressed by research aimed at understanding an important part of that story – the nature and depth of the relationship between PSE and the evolution of the labour market. Therefore, understanding and improving the coordination and adjustment processes (and outcomes) taking place between PSE and the labour market may indeed prove to be an issue just as crucial to Canadian innovation and growth in living standards as it is a complex and multi-faceted one.

[25] See also Boyer and Atallah (2001) and Boyer *et al.* (1999), who present and use a number of indicators to identify potential shortages such as the existence of an economic rent for certain categories of workers; sudden increases in wages; variations in staff turnover; and particularly low unemployment rates for certain fields.

8. Summary of Research Issues and Research Priorities

This section lists all the research questions suggested throughout the text. However, the exclusion of other topics not presented as questions should not mean that these would be left out of a potential research agenda. The main research directions we identify are presented in a separate sub-section.

Summary of detailed research questions

❑ *How frequent are these types of contracts, where employers directly pay for – or provide – their employees' PSE?*
❑ *Under what circumstances are they most likely to emerge?*
❑ *What types of firms, workers and institutions (colleges, universities) are involved?*
❑ *Are positive externalities to PSE observable?*
❑ *If so, how large are these externalities in Canada, and of what kind are they?*
❑ *What are (well-working) examples of jurisdictions using market pricing for PSE?*
❑ *Do PSE institutions operating in such a setting exhibit a greater level of adjustment to labour market?*
❑ *How do the British and Australian ICLPs perform with respect to their goals?*
❑ *Which elements of these programs could be implemented in the Canadian context?*
❑ *How frequent are these employer-student arrangements, for training that is relatively general in nature?*
❑ *Under what circumstances are they most likely to emerge?*
❑ *What type of individuals and employers are involved?*
❑ *Generally speaking, what are the institutional barriers to adjustment by PSE institutions (such as delays in faculty hiring and equipment replacement)?*
❑ *How do these barriers vary depending on the specificity of the training provided?*
❑ *How do these barriers vary depending on the type of PSE institution?*
❑ *Is there evidence that the political market, rather than the labour market, is the reference for PSE institutions?*
❑ *How is rationing used by PSE institutions to manage their supply?*
❑ *Is there cross-subsidization in Canadian PSE institutions?*
❑ *If so, how substantial is this phenomenon and how does it impact the institutions' adjustment in different fields – if at all?*
❑ *In how many and in which fields do governments directly manage PSE supply?*
❑ *What is the institutions' leeway for adjustment in such contexts?*

How can the following variables/dimensions of the adequacy of adjustment be analyzed – both at the Canadian and international levels?

- *Level of completers, at each level and in different fields of study;*
- *Success of graduates' career path and/or satisfaction of the graduates in this matter;*
- *Returns to PSE in different fields, changes in the latter, trends analyses;*
- *Matching of employment and graduation trends;*
- *Correlation between characteristics of PSE systems (such as structure, attendance, rules, financing sources) and their response ability;*
- *Pattern of response to short-term changes versus response to long-term changes: trends comparisons;*
- *Possible existence of shortages in different fields and at different times.*

- *How do these variables/dimensions perform at measuring the adequacy of adjustment?*
- *What other types of data are needed to better quantify (and compare) adjustment levels?*

- *How do the different determinants of adult education affect these students' "signalling" function?*
- *Is this role similar to the one played by students in their initial training?*
- *How important is the uncertainty faced by students?*
- *How does this affect their choices?*
- *Would it be possible to foster the development of some sort of "livelihood insurance"?*
- *How is it possible to adapt the contents of training to ensure a minimum level of general training as a form of insurance?*

- *How good is the information provided by PSE institutions to students?*
- *What are the unfilled information needs of students (on labour market, programs...)?*
- *Who should provide this information, and how?*
- *Does the above differ according to socio-economic status – or other variables?*

Main Research Directions Proposed

This sub-section outlines the broad research directions and possibilities underlying the various themes discussed in this paper. These directions are listed in order of importance and are seen by the authors as covering the most important economic aspects of the question under study.

1) (Possibilities of) Disentanglement of the respective roles in PSE of price and income support mechanisms
   - *Literature reviews*
   - *Canadian and international experiences*
2) Identification and description of the institutional barriers to PSE adjustment to labour market and consequences of these barriers
   - *Breakdowns and analyses by fields of study*
   - *Breakdowns and analyses by types of institutions*
3) Exploration and analysis of the different dimensions of the adequacy of PSE adjustment
   - *Optimal use of existing data*
   - *Definition of precise data needs*
4) Understanding of the determinants of students' educational and career choices
5) Analysis and description of the determinants of firms-sponsored training and the circumstances surrounding employer/students adjustment

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